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Original Research Article

Factors affecting the adoption of modern fish farming technologies in Gokwe South District, Zimbabwe

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ABSTRACT

Background: Fish are a source of cheap protein to many rural communities in Zimbabwe. Unfortunately, very few fish farmers are not willing to adopt modern fish farming technologies in order to boost fish production. The study was carried out in order to establish the factors that are affecting fish farmers in adopting the modern fish farming technologies in Gokwe South District, Zimbabwe.
Methods: A household survey using a structured questionnaire was administered in February 2022.
Results: Sixty-four respondents participated in the survey and the majority (73%) were males. Most (47%) of the fish farmers were above 46 years. The common source of fish farming information was through non-governmental organizations (NGO) (40%) and through government departments (27%). The challenges affecting fish farmers in the area included financial constraints (40%), absence of markets (26%), lack of fishing equipment in local shops (13%) and the absence of fishing inputs and equipment in local shops (13%). Water shortage was the major (27%) factor affecting the adoption of modern technologies and this was followed by financial constraints (20%), political interference (20%), traditional and cultural beliefs (13%) and lack of knowledge (7%).
Conclusions: Modern fish farming technologies need to be fully embraced to raise both food and nutrition security particularly in rural communities. This can be achieved by the involvement of the government, traditional leaders, NGO and other stake holders in the provision of funds, training, monitoring and implementing of fishery projects in the area.

Keywords: Aquaculture, Gokwe, Stakeholder, Technology

INTRODUCTION

Aquaculture has expanded from being almost negligible to fully comparable with capture production in terms of feeding people in the world.[1] Additionally, aquaculture has also evolved in terms of technological innovation and adaptation to meet changing fishing requirements. In the past 50 years application of science and the introduction of new technologies in aquaculture development have promoted the rapid development of fish farming.[2] Modern fishing technologies have contributed significantly to fish production; for example reproductive technologies have allowed farmers to close the life cycle of aqua-species which provides for species and diversification.[3] It is also important to note that selective breeding together with quantitative genetics have substantially improved fish traits.[4] Sex reversal technology and DNA markers associated with sex determination have enabled the production of monosex tilapia's, yellow catfish and river shrimps. Molecular parentage has also allowed intra-family selection in mass crosses, thus reducing inbreeding.[5] Improved feed formulation based on nutritional requirements of each fish species have improved feed conversion rate (FCR), thus reducing feed costs.[6] Modern technologies for disease management have reduced the occurrence of

diseases in aquaculture for example bacterial, fungal and nutritional diseases. These technologies include genomic selection (GS), genome editing (GE), recirculating aquaculture system (RAS), off show farming and oral vaccine.[7]

Modern technologies can aid in the growth of an aquaculture sector through (i) greater farm productivity, (ii) increased fish supply and reduction in consumer prices, (iii) increased trade and export of fish, and (iv) employment generation that benefits overall development.[8,9] Dissemination of technologies such as artificial spawning of commercially important species, improved feeds and feeding technologies, enhanced production systems, disease management, and genetically improved fish strains have been shown to have triggered aquaculture development in shrimp, salmon, and tilapia industries.[10]

Zimbabwe has relatively developed aquaculture and is retained to be one of the top ten fish farming countries in Sub-Saharan Africa. In 2014, the total production was estimated at 10 600 tonnes and much of production were Nile tilapia raised in floating cages in Lake Kariba operated by the Lake Harvest company, one of the leading aquaculture firms in Africa. The national potential demand for fish in Zimbabwe is estimated at 60,000 MT per year and with a total production of approximately 25,000 MT, thus there is an estimate deficit of 35,000MT.[11] In order to satisfy this deficit, precise use of modern aquaculture technologies by the farmers is essential. As much as, these modern technologies have developed and advanced rapidly in recent decades, not all these technologies have been embraced readily and rapidly by fish farmers in Zimbabwe. It is therefore important to identify the constraints that are affecting fish farmers in adopting modern fish farming technologies before recommending programs that are aimed at facilitating the adoption of these technologies. The main objectives of the study were to i) determine the demographic characteristics of fish farmers in Gokwe South District, ii) determine the source of fish farming information iii) establish the challenges faced by fish famers in Gokwe South and (iv)to establish the factors affecting adoption of modern fish farming technologies.

METHODS

Study area

Gokwe South District lies within agro-ecological region III and IV (Figure 1). The annual rainfall is in the range of 450-650 mm. The area has mid-season dry spells and high temperatures of 18-35ºC. Most of the farmers are small holder farmers with limited land size who practise mixed farming.[13] Soils in Gokwe South District are mainly sandy soils, of Kalahari origin and they are rich in inherent fertility, characterized by low soil organic carbon.[14,15] Dryland crop production is the major income generating activity in the district and the major food crops are maize, sorghum, cowpeas and groundnuts while cotton, sunflower, sweet potatoes are cash crops.[16] Vegetation ranges from tree bush savannah to bush tree savannah.[13]

Data collection

A descriptive cross-sectional study was conducted in February 2022 using a structured questionnaire to solicit responses from fish farmers. The purpose of the study, confidentiality and voluntary nature of the survey were explained to potential respondents. The questionnaire had four sections; a) Demographic profile; b) Source of information; c) Challenges faced by fish farmers; d) Factors affecting the adoption of modern fish farming technologies. A sample of 64 respondents (5% of the population of fish farmers) was selected at random using random number tables and a map of district household.[17]

Data analysis

Microsoft excel was used for data cleaning, editing, sorting, and coding. Descriptive statistics (i.e., frequencies, percentages) was used to analyze the data.

RESULTS

Demographic characteristics

Sixty-four respondents were interviewed and most (73%) were males (Table 1). Most fish farmers (47%) were above 46 years followed by the 36-45 years (27%) age group. The other two groups (less than 25 years and 26-35 years) were the same (13%). The majority (47%) of the respondents never attended school. Thirty percent of the respondents had primary school education, while 20 % had secondary school education. Very few fish farmers (3%) had tertiary education.

Sources of fish farming information

Most (40%) fish farmers got their information from NGO (Figure 1). This was followed by government departments (27%). Twenty percent of the respondents “had no idea” as to where they get their fish farming information. Few farmers (13%) relied on the oral source of information.

Challenges faced in embracing modern fish farming technologies

Most (40%) respondents faced financial constraints while 26% indicated the absence of fish markets (Table 2). Other challenges reported include lack of fishing equipment in local shops (13%) and the unavailability of fishing inputs in local shops (13%).

Factors affecting the adoption of modern fishing technology

Water shortage (27%) followed by financial constraints (20%) and political interference (20%) were the most important factors affecting the adoption of modern fishing farming technologies (Figure 2). Traditional beliefs (13%) also affected the adoption of fish technology. Thirteen percent of the respondents indicated that they had no idea as to what was affecting the adoption of modern fish farming technologies. Few farmers (7%) cited lack of knowledge as a factor influencing the adoption of modern fishing farming technologies.

Table 1: Demographic characteristics of the study population, (n=64).

Variables	Percentage (%)
Household head	
Male	73
Female	27
Age (Years)	
<25	13
26-35	13
36-45	27
>46	47
Educational level	
Never attended school	47
Primary education	30
Secondary education	20
Tertiary education	3

Table 2: Challenges in adopting modern fish farming technologies, (n=64).

Challenge	Percentage (%)
Financial constraint	40
Absence of fish market	26
Lack of fishing equipment in local shops	13
No shops with fishing inputs	13

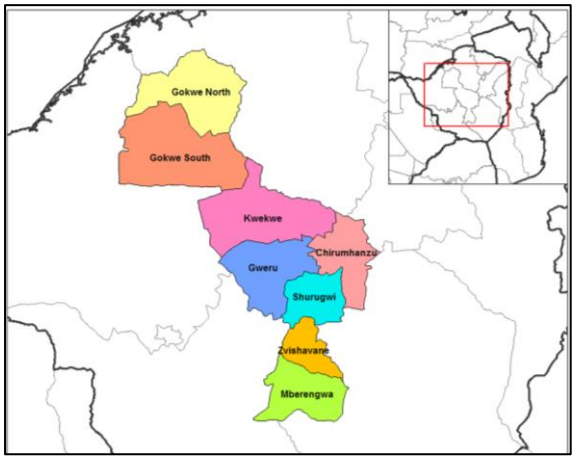

Figure 1: A map showing the study area.
https://upload.wikimedia.org/wikipedia/commons/thumb/3/34/Midlands_districts.png.[17]

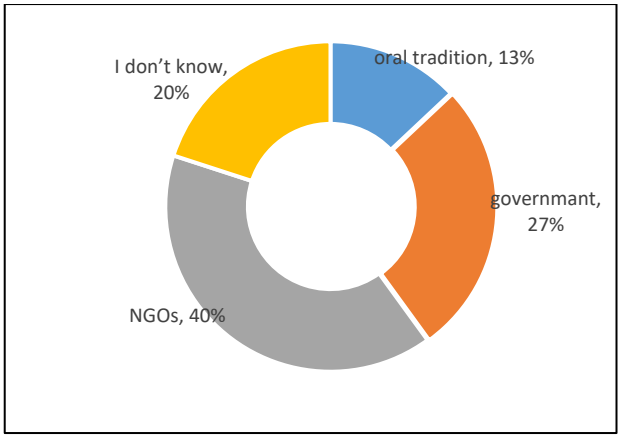

Figure 2: Sources of knowledge for modern fish farming technologies.

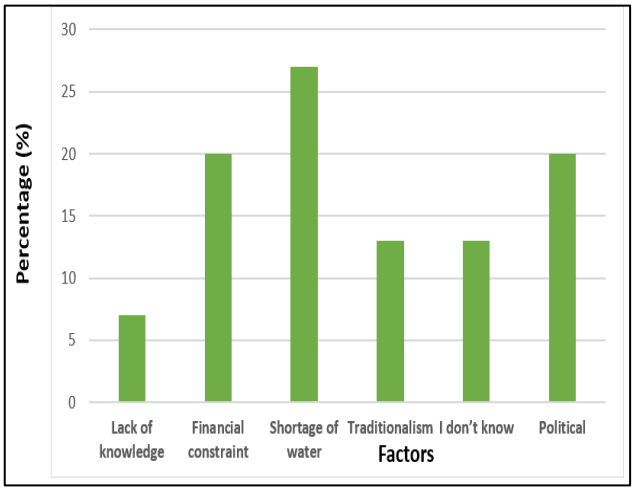

Figure 3: Factors affecting the adoption of modern fishing technologies

DISCUSSION

According to the United Nations secretary-general's high-level panel on women's economic empowerment women are just 13% of agricultural land holders globally.[18] This was confirmed in this study as most (73%) of the fish farmers were males. Though the involvement of women in the current study was slightly higher (27%), it still indicates how limited the female counterpart is in terms of development. Therefore, there is need for some educational and awareness programmes on gender equality and women empowerment in the rural communities of Gokwe South district. It has been reported that household head age is of importance in agricultural productivity as indicated by the level of experience that a person attains as they grow old in their day-to-day agricultural activities.[19] This agrees with the finding of the current study in which most of the fish farmers were more than 46 years old, indicating the influence of age on fish farming in Gokwe South District. It is worth noting that 26% of the youths (less than 35 years) were into fish farming, implying that the enterprise

is missing out on a more active group, who would enhance productivity and commercialization.[20] In terms of education, it was observed that most (47%) of the fish farmers had never attended school. This high illiteracy level could be a drawback as the illiterate community is unlikely to adopt and practice new technologies. This, as a result, may not enhance commercialization of the enterprise.

Most (40%) of the respondents received fish farming information from NGO indicating that the NGOs are playing an important role in educating the community on fish farming. The only complaint raised by the fish farmers was that the NGOs abandoned the fishery projects soon after their inception and this negatively affected the continuation of the projects. The government was also playing an important role in disseminating information to the community as 27% of the respondents confirmed that they got fish farming information from some government departments. Few farmers (13%) received fish farming information through oral communication and this source of information was marred by cultural beliefs in the area. For example, one of the headmen commented in Shona that *"*Hove dzenyu dzechirungu idzi dzikakandwa mumadziva edu aya dzinoomesa mvura. Madziva edu aya ane varidzi vawo" which literally translates to "If your exotic fish are introduced in our rivers, the water will dry off. These rivers have their owners." Probed further on what was meant by "…rivers have their owners" the fish farmer explained that these available water reservoirs were sacred. These sentiments aired by the research respondents highlights the importance of slow technology diffusion within a community because of various cultural beliefs and practices.[21] The new technologies would disturb people's way of living as some of their natural resources could be of cultural significance to the entire community. The respondent implored that the locals would be contented with their wild breeds though they take long to mature.

Financial constraint was also raised as a challenge affectingnn fish farming technology. For example one of the fish farmers argued; "We cannot move from crop production to fish farming because we do not have money to construct fish ponds or buy inputs due to poor payments we get from crops." It was also important to note that the absence of a market was a challenge considering that the nearby Gokwe town is very small. Consequently, fish farmers end up barter trading their produce and this stifles the growth of their fishing enterprises. Further to that, there are few shops in Gokwe and these few shops do not stock fish inputs and fishing equipment.

Water shortage was observed as a main factor affecting the adoption of modern fishing technology. It also emerged that available wetlands were converted to crop and livestock production hence led to loss of vital wetland ecosystem services which could have been utilized for fish farming. Most small dams and streams dry off during the winter season forcing some farmers to drill boreholes. This discouraged farmers to engage into fish farming. Water usage was further exacerbated by political interference in the area. For example, one respondent indicated that in 2014, the Department of Environment Management Agency (EMA) recommended fish farmers to construct fish ponds in order to better utilize available wetlands. However, conflicting local leadership allocated these wetlands to crop production hence degrading the wetlands. In this research, political inferences was also observed to disturb the farmers as some were forced to move their fish ponds away from swampy areas. It was noted that different governing structures advocate for different policies or approaches to development activities in an area. For example, while EMA advocated for fish farming in wetlands, traditional leaders were against it such that they allocated the wetlands to crop farmers. This discouraged local farmers to adopt modern fish farming in Gokwe South district despite efforts from the development agencies.

Information technology investment and adoption creates some rational expectations perspective in any community.[22] However, in this study, tradition was observed to play a big part in the adoption of modern technology. Quite a number of respondents believed that their traditional products could sustain their current fishing activities. They believed that modern and exotic products could cause drying up of water sources. Therefore, these modern fish farming technologies have to adapted to a "degree that supports the spheres of local culture, solidarity and social links."

Lack of knowledge was also cited as a factor affecting the adoption of modern fishing technology. However, there were mixed feelings to this as some respondents confirmed that they got information on fish farming from extension officers, while some fish farmers revealed that they did not receive any education on fish farming. However, it was noted that most fish farmers struggled because most of the information they got was just theoretical. More so the information they got was mainly on wild fish breeds and traditional feeds like feeding fish with waste beer material (masese).

CONCLUSIONS

Given the overall purpose of the study of determining the factors affecting adoption of modern fish farming technologies in Gokwe South district, this research came up to the following conclusion and recommendations:

Most people are aware of their benefits especially health wise. However, modern fish farming technologies need to be fully embraced and adopted to raise both food and nutrition security of rural communities. It has to accepted that fish farming should be taken as farming business enterprise through development education.

The study established that the adoption of modern fish farming technology in Gokwe South district is affected by lack of knowledge on modern fish farming technologies (education), high fish pond establishment costs (economic), insufficient water (environmental), resistance to change (socio-cultural) and political disturbances. Insufficient water supply to support modern fish farming technology was identified as the major factor.

Rural communities receive most information on modern fish farming technology from NGOs and the government. The NGOs work for stipulated time frames while government has permanent operational structures in the rural areas

The government department responsible for the fishery sector should be capacitated in order to train, monitor and implement fishery projects.

Provision of adequate funding for fish farming projects and projects must extend for a considerably long term to enable assimilation of the modern technology

Non-Governmental Organizations are encouraged to work closely with government departments from inception of fishery projects up to fully operational of the projects.

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